CLAIMS

[1] A turbine component applied to a gas turbine engine and rotatable around an axial center of the gas turbine engine, the turbine component characterized by comprising:

a component main body; and

a protective coating having oxidation resistance and abrasiveness, the protective coating being formed on a portion to be processed of the component main body,

wherein the protective coating is formed by employing an electrode composed of a molded body molded from a mixed powder of a powder of an oxidation-resistant metal and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge.

[2] The turbine component recited in claim 1, characterized in that the oxidation-resistive metal is any one of or a mixed material of two or more of a NiCr alloy and M-CrAlY.

[3] The turbine component recited in claim 1 or claim 2, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[4] The turbine component recited in any claim from claim 1 to claim 3, characterized in that a surface side of the protective coating is processed with a peening treatment.

[5] A production method for production of a turbine component of a gas turbine engine and rotatable around an axial center of the gas turbine engine, the production method of the turbine

component characterized by comprising:

a main body formation step forming a major part of a component main body by forging or casting and forming a remaining part of the component main body by machining;

a coating formation step forming a protective coating having oxidation resistance and abrasiveness by employing an electrode composed of a molded body molded from a mixed powder of a powder of an oxidation-resistant metal and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge after finishing the main body formation step.

[6] The production method of the turbine component recited in claim 5, characterized in that the oxidation-resistive metal is any one of or a mixed material of two or more of a NiCr alloy and M-CrAlY.

[7] The production method of the turbine component recited in claim 5 or claim 6, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[8] The production method of the turbine component recited in any claim from claim 5 to claim 7, characterized by comprising;

a peening step processing a surface side of the protective coating with a peening treatment after finishing the coating formation step.

[9] The production method of the turbine component recited in any claim from claim 5 to claim 8, characterized in that the turbine component is a turbine rotor blade.

[10] A surface treatment method for carrying out a surface treatment with respect to a component main body as a constituent element of a turbine component applied to a gas turbine engine and rotatable around an axial center of the gas turbine engine so as to ensure oxidation resistance and abrasiveness resistance, the surface treatment method characterized by:

forming a protective coating having oxidation resistance and abrasiveness by employing an electrode composed of a molded body molded from a mixed powder of a powder of an oxidation-resistant metal and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge.

[11] The surface treatment method recited in claim 10, characterized in that the oxidation-resistive metal is any one of or a mixed material of two or more of a NiCr alloy and M-CrAlY.

[12] The surface treatment method recited in claim 10 or claim 11, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[13] The surface treatment method recited in any claim from claim 10 to claim 12, characterized in that a peening treatment is processed to a surface side of the protective coating after forming the protective coating.

[14] The surface treatment method recited in any claim from claim 10 to claim 13, characterized in that the turbine component is a turbine rotor blade.

[15] A turbine component applied to a gas turbine engine,

characterized by comprising:

a component main body;

a hard first protective coating having abrasiveness or erosion resistance, the first protective coating being formed on a first portion to be processed; and

a second protective coating having oxidation resistance, the second protective coating being formed on a second portion to be processed including the first portion to be processed in the component main body so as to cover the first protective coating,

wherein the first protective coating is formed by employing an electrode composed of a molded body molded from a powder of one material or a powder of two or more mixed materials of a powder of a metal, a metal compound and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the first portion to be processed of the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge.

[16] The turbine component recited in claim 15, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[17] A turbine component applied to a gas turbine engine, characterized by comprising:

a component main body;

a hard first protective coating having abrasiveness or erosion resistance, the first protective coating being formed on a first portion to be processed; and

a second protective coating having oxidation resistance, the second protective coating being formed on a second portion to be processed including the first portion to be processed in the component main body so as to cover the first protective coating,

wherein the first protective coating is formed by employing an electrode composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the first portion to be processed of the component main body and the electrode in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge.

[18] The turbine component recited in any claim from claim 15 to claim 17, characterized in that the oxidation-resistive coating is formed by an aluminizing treatment, a chromizing treatment, CVD or PVD.

[19] The turbine component recited in any claim from claim 15 to claim 18, characterized by being so constituted that a coverage of the first protective coating is 60% or more and 95% or less.

[20] A surface treatment method for carrying out a surface treatment with respect to a component main body as a constituent element of a turbine component applied to a gas turbine engine, the surface treatment method characterized by:

forming a hard first protective coating having abrasiveness or erosion resistance by employing an electrode composed of a molded body molded from a powder of any one of or a mixed material of two or more of a powder of a metal, a powder of a metal compound and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between a first portion to be processed of the component main body and the electrode so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge; and

forming a second protective coating having oxidation

resistance on a second portion to be processed including the first portion to be processed in the component main body by an aluminizing treatment, a chromizing treatment, CVD or PVD so as to cover the first protective coating.

[21] The surface treatment method recited in claim 20, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[22] A surface treatment method for carrying out a surface treatment with respect to a component main body as a constituent element of a turbine component applied to a gas turbine engine, the surface treatment method characterized by:

forming a hard first protective coating having abrasiveness or erosion resistance by employing an electrode composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between a first portion to be processed of the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge; and

forming a second protective coating having oxidation resistance on a second portion to be processed including the first portion to be processed in the component main body by an aluminizing treatment, a chromizing treatment, CVD or PVD so as to cover the first protective coating.

[23] The surface treatment method recited in any claim from claim 20 to claim 22, characterized in that a coverage of the first protective coating is 60% or more and 95% or less.

[24] The surface treatment method recited in any claim from claim 20 to claim 23, characterized in that the turbine component is

a turbine rotor blade, the first portion to be processed is a tip end portion of a blade in a rotor blade main body as the component main body and the second treatment subject region is the whole of blade faces of the blade.

[25] The surface treatment method recited in any claim from claim 20 to claim 24, characterized in that the turbine component is a turbine rotor blade, the first portion to be processed is a region ranging from a leading edge to a pressure sidewall of a blade in a rotor blade main body as the component main body and the second treatment subject region is the whole of blade faces of the blade.

[26] A turbine component applied to a gas turbine engine, characterized by comprising:

a component main body;

a porous base coating having oxidation resistance and heat-shielding property, the porous base coating being formed on a portion to be processed by energy of an electric discharge;

an intermediate coating composed of a composite material consisting primarily of at least any one of SiC and $MoSi_2$ which is changeable into SiO_2 having fluidity when the gas turbine engine is in operation, the intermediate coating being formed on a surface side of the base coating;

a hard protective coating being composed of an oxide series ceramic, cBN, a mixture of the oxide series ceramic and the oxidation-resistant metal or a mixture of cBN and the oxidation-resistant metal and having abrasiveness, erosion resistance or oxidation resistance, the protective coating being formed on a surface side of the intermediate coating by energy of an electric discharge.

[27] The turbine component recited in claim 26, characterized in that:

the base coating is formed by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal oxide or the molded body processed with a heat treatment, and generating a pulsing electric discharge

between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge;

the intermediate coating is formed by employing an electrode for the intermediate coating composed of a molded body molded from a powder of the composite material or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the electrode for the intermediate coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the intermediate coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge; and

the protective coating is formed by employing an electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the intermediate coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the intermediate coating by energy of the electric discharge.

[28] The turbine component recited in claim 26, characterized in that:

the base coating is formed by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal oxide or the molded body processed

with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge;

the intermediate coating is formed by employing an electrode for the intermediate coating composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the electrode for the intermediate coating in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge; and

the protective coating is formed by employing an electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the intermediate coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the intermediate coating by energy of the electric discharge.

[29] A turbine component applied to a gas turbine engine, characterized by comprising:

a component main body;

a base coating having oxidation resistance and heat shielding

property, the base coating being formed on a portion to be processed by energy of an electric discharge;

a hard protective coating having abrasiveness, erosion resistance or oxidation resistance, the protective coating being formed on a surface side of the base coating by energy of an electric discharge and composed of an oxide series ceramic or a mixture of the oxide series ceramic and the oxidation-resistant metal, pores of which are filled with an amorphous material of glassy SiO_2.

[30] The turbine component recited in claim 29, characterized in that:

the base coating is formed by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge; and

the protective coating is formed by employing an electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge.

[31] The turbine component recited in any claim from claim 26 to claim 30, characterized in that the oxidation-resistant metal is one or more metals of M-CrAlY and NiCr alloy, and the oxide series ceramic is yttria-stabilized zirconia.

[32] A surface treatment method for carrying out a surface treatment with respect to a portion to be processed of a component main body as a constituent element of a turbine component applied to a gas turbine engine, the surface treatment method characterized by:

forming a porous base coating having oxidation resistance and heat-shielding property by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge;

forming an intermediate coating which is changeable into SiO_2 having fluidity when the gas turbine engine is in operation by employing an electrode for the intermediate coating composed of a molded body molded from a powder of a composite material consisting primarily of at least any one of SiC and $MoSi_2$ or the compressed powder body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the electrode for the intermediate coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the intermediate coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge;

forming a hard protective coating having abrasiveness, erosion resistance or heat-shielding property by employing an

electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the intermediate coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the intermediate coating by energy of the electric discharge.

[33] A surface treatment method for carrying out a surface treatment with respect to a portion to be processed of a component main body as a constituent element of a turbine component applied to a gas turbine engine, the surface treatment method characterized by:

forming a base coating having oxidation resistance and heat-shielding property by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge;

forming an intermediate coating which is changeable into SiO_2 having fluidity when the gas turbine engine is in operation by employing an electrode for the intermediate coating composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the

electrode for the intermediate coating in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge; and

forming a hard protective coating having abrasiveness, erosion resistance or heat-shielding property by employing an electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the intermediate coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the intermediate coating by energy of the electric discharge.

[34] A surface treatment method for carrying out a surface treatment with respect to a portion to be processed of a component main body as a constituent element of a turbine component applied to a gas turbine engine, the surface treatment method characterized by:

forming a porous base coating having oxidation resistance and heat-shielding property on the portion to be processed of the component main body by employing an electrode for the base coating composed of a molded body molded from a powder of an oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the portion to be processed of the component main body and the electrode for the base coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the base coating or a reaction substance of the electrode material carries

out deposition, diffusion and/or welding on the portion to be processed of the component main body by energy of the electric discharge;

forming a hard protective coating having abrasiveness, erosion resistance or oxidation resistance by employing an electrode for the protective coating composed of a molded body molded from a powder of the oxide series ceramic, a powder of cBN, a mixed powder of a powder of the oxide series ceramic and a powder of the oxidation-resistant metal or a mixed powder of a powder of cBN and a powder of the oxidation-resistant metal or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the base coating and the electrode for the protective coating in an electrically insulating liquid or gas so that an electrode material of the electrode for the protective coating or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on a surface side of the base coating by energy of the electric discharge; and

further, closing pores of the protective coating by SiO_2 by filling a powder of SiO_2 or $MoSi_2$ into the pores of the protective coating, heating the portion to be processed of the component main body and changing the powder of SiO_2 or $MoSi_2$ into an amorphous material composed of glassy SiO_2.

[35] The surface treatment method recited in any claim from claim 32 to claim 34, characterized in that the oxidation-resistant metal is one or plural metals of M-CrAlY and NiCr alloy, and the oxide series ceramic is yttria-stabilized zirconia.

[36] A gas turbine engine characterized by comprising the turbine component recited in any claim of from claim 1 to claim 4, from claim 15 to claim 19, and from claim 26 to claim 31.

[37] A metal component characterized by comprising:

a component main body;

a hard protective coating having erosion resistance, the protective coating being formed at a portion to be processed of the component main body,

wherein the protective coating is formed by employing an electrode composed of a molded body molded from a mixed powder of a powder of a metal or a powder of a metal compound and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the predetermined region in the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the predetermined region of the component main body by energy of the electric discharge.

[38] The metal component recited in claim 37, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[39] A metal component characterized by comprising:

a component main body;

a hard protective having erosion resistance composed of SiC, the protective coating being formed at a portion to be processed of the component main body,

wherein the protective coating is formed by employing an electrode composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the first portion to be processed of the component main body and the electrode in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge.

[40] The metal component recited in any claim from claim 37 to claim 39, characterized in that a surface side of the protective coating is processed with a peening treatment.

[41] A blade component applied to a gas turbine engine or a steam turbine engine, characterized by comprising:

a component main body;

a hard protective coating having erosion resistance, the protective coating being formed at a portion to be processed of the component main body,

wherein the protective coating is formed by employing an electrode composed of a molded body molded from a mixed powder of a powder of a metal or a powder of a metal compound and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the predetermined region in the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the predetermined region of the component main body by energy of the electric discharge.

[42] The blade component recited in claim 41, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[43] A blade component applied to a gas turbine engine or a steam turbine engine, characterized by comprising:

a component main body;

a hard protective having erosion resistance composed of SiC, the protective coating being formed at a portion to be processed of the component main body,

wherein the high-hardness coating is formed by employing an electrode composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the first portion to be processed of the component main body and the electrode in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition,

diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge.

[44] The blade component recited in any claim from claim 41 to claim 43, characterized in that a surface side of the high-hardness coating is processed with a peening treatment.

[45] A gas turbine engine characterized by comprising the blade component recited in any claim from claim 41 to claim 44.

[46] A steam turbine engine characterized by comprising the blade component recited in any claim from claim 41 to claim 44.

[47] A surface treatment method for carrying out a surface treatment with respect to a portion to be processed of a component main body as a constituent element of a metal component so as to ensure erosion resistance, the surface treatment method characterized by:

forming a hard protective coating having erosion resistance by employing an electrode composed of a molded body molded from a mixed powder of a powder of a metal or a powder of a metal compound and a powder of a ceramic or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the predetermined region in the component main body and the electrode in an electrically insulating liquid or gas so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the predetermined region of the component main body by energy of the electric discharge.

[48] The surface treatment method recited in claim 47, characterized in that the ceramic is any one of or a mixed material of two or more of cBN, TiC, TiN, TiAlN, TiB_2, WC, SiC, Si_3N_4, Cr_3C_2, Al_2O_3, ZrO_2-Y, ZrC, VC and B_4C.

[49] A surface treatment method for carrying out a surface treatment with respect to a portion to be processed of a component

main body as a constituent element of a metal component so as to ensure erosion resistance, the surface treatment method characterized by:

forming a hard protective coating having erosion resistance by employing an electrode composed of a solid body of Si, a molded body molded from a powder of Si, or the molded body processed with a heat treatment, and generating a pulsing electric discharge between the first portion to be processed of the component main body and the electrode in an electrically insulating liquid including alkane hydrocarbons so that an electrode material of the electrode or a reaction substance of the electrode material carries out deposition, diffusion and/or welding on the first portion to be processed of the component main body by energy of the electric discharge.

[50] The surface treatment method recited in any claim from claim 47 to claim 49, characterized in that a surface side of the protective coating is processed with a peening treatment after forming the protective coating.

[51] The surface treatment method recited in any claim from claim 47 to claim 50, characterized in that the metal component is a blade component applied to a gas turbine engine or a steam turbine engine.